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WELDING PROCESS FOR JOINING A NODULAR, DUCTILE CAST IRON COMPONENT TO A STEEL COMPONENT

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WELDING PROCESS FOR JOINING A NODULAR, DUCTILE CAST-IRON COMPONENT TO A STEEL COMPONENT

[Schweißverfahren zum Verbinden eines Sphäroguß-Bauteiles mit einem Stahl-Bauteil]

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Claims

1. Welding process for joining a first component, which comprises ferritic, nodular, ductile cast iron, to a second component comprising steel, especially for revamping the housings of mechanical accessories, with an electrode that melts away, characterized by the feature that use is made of a steel wire electrode as the additional working material, whereby the welding thereof takes place with argon, CO_2 or a two-component gas mixture or a three-component gas mixture comprising argon, CO_2 and O_2 using the impulse mode of operation at a pulse frequency of 50-150 Hz, whereby the joints are made in the form of a V seam or an HV seam with minimization of the quantity of heat that is introduced via the welding process.

2. Process in accordance with Claim 1, characterized by the use of a nickel-free steel wire.

3. Process in accordance with Claim 1 or 2, characterized by the feature that use is made of a steel wire with a diameter of 0.8-1.2 mm with a welding current intensity of 140-280 A.

4. Process in accordance with Claim 1, 2, or 3, characterized by the feature that the mechanical/technological properties of the steel wire that is used achieve at least the values of the two basic working materials of the components.

5. Process in accordance with one of the preceding claims, characterized by the feature that the welding speed amounts to 15-35 cm/min.

6. Process in accordance with one of the preceding claims, characterized by the feature that the quantity of protective gas that is used amounts to 8-20 L/min.

7. Process in accordance with one of the preceding claims, characterized by the feature that the protective gas is admitted to the sealed-off housing of the mechanical accessory in order to achieve root protection.

8. Process in accordance with one of the preceding claims, characterized by the feature that the root is welded with bath protection.

9. Process in accordance with one of the preceding claims, characterized by a ferritizing annealing process that is carried out thereafter, whereby, as a result of this annealing, the cementite decomposes in the heat input zone on the cast-iron side and coarse grain formation does not yet occur on the steel side.

10. Welding process for joining a first component comprising ferritic, nodular, ductile cast iron to a second component comprising steel, especially for revamping the housings of mechanical accessories, with an electrode that does not melt away, characterized by the feature that a steel wire is fed in in the cold or warm state as the additional working material and the welds are made using the plasma process, whereby the root is welded, without the addition of additional working material, using the plug welding technique with bath protection .

11. Welding process in accordance with Claim 10, characterized by the feature that argon with an addition of 5.4% of hydrogen is used as the plasma gas.

12. Welding process in accordance with one of the preceding claims, characterized by the feature that root welding is carried out using the tungsten/inert gas welding process or the plasma welding process, whereas the filling sites are deposited using the metal/active gas welding process and use is made of steel wire in both processes.

The invention pertains to a welding process for joining a first component comprising ferritic, nodular, ductile cast iron to a second component comprising steel, especially for revamping the housings of mechanical accessories, with an electrode that melts away.

Cast-iron mechanical accessories are usually constructed with flange joints that oppose corrosive attack with only low resistance. Thus attempts have been made to manufacture

cast-iron mechanical accessories with a projecting steel tube. Joining of the steel tube and the cast-iron fitting hereby took place via a fillet seam so that a gap between the two materials remained in the interior of the tube. This gap, likewise, forms a point for corrosive attack.

What is more, the joints were made with nickel-based additional materials. As a result of the different potentials between the steel tube, the cast-iron mechanical accessory and the nickel-based additional material, there is a risk of local element formation and hence increased attack via corrosion. In addition, it has been found that nickel martensite, which dissolves only after several hours of annealing at 900°C, is formed in the melt line.

The problem that forms the basis of the invention is to further develop the process, which was explained at the beginning, in such a way that cast-iron/steel joints can be made in the foundry while avoiding the disadvantages that are linked to the previously known processes.

In accordance with the invention, this problem is solved by making use of a steel wire electrode as the additional working material, whereby the welding thereof takes place with argon, CO_2 or a two-component gas mixture or a three-component gas mixture comprising argon, CO_2 and O_2 using the impulse mode of operation with a pulse frequency of 50-150 Hz, whereby the joint is made in the form of a V seam or an HV seam with minimization of the quantity of heat that is introduced via the welding process.

In this way, it leads to special advantages if use is made of nickel-free steel wire. This steel wire can have a diameter of 0.8-1.2 mm, and is used at a welding current intensity of preferably 140-280 A. In this way, the mechanical/technological properties of the steel wire that is used should achieve at least the values of the two basic working materials of the components.

Use can be made of the fully mechanized electric arc welding process tungsten/inert gas welding and plasma welding with cold wire addition or hot wire addition, metal/inert gas welding and metal/active gas welding for the welding of housings of mechanical accessories, whereby the housings comprise GGG-35.5 or GGG-40.3 with suitable steel tube sections. Mechanization of the processes by making use of a suitable rotating device, which permits both sides of the housing of the mechanical accessory to be welded simultaneously, takes place in the case of rotationally symmetrical parts. Preheating of the components can be provided depending on the suitability for welding of the particular quality of steel tube that is used.

A ferritizing annealing process is usually carried out following the welding process in accordance with the invention, whereby, as a result of this annealing, the cementite decomposes in the heat input zone on the cast-iron side and coarse grain formation does not yet occur on the steel side.

The nodular, ductile, basic cast iron that is used should be of high technical purity since accompanying elements and trace elements limit its suitability for welding. As a result of the process in accordance with the invention, one avoids the situation in which martensite and

ledeburite make the welded joint brittle. The nickel-free welded object prevents the formation of nickel martensite and is more favorable in terms of cost than the nickel-containing additional working material. Since, however, the steel wire has a lower ductility than the basic nickel addition, the heat affected zone must be minimized via technical welding process optimization.

The welding speed preferably amounts to 15-35 cm/min, whereby both burner movement and work piece movement are provided during the mechanized welding process.

The quantity of protective gas that is used preferably amounts to 8-20 L/min, whereby an angle of incidence of 10-90° is to be maintained for the burner.

In the case of scrupulous seam preparation, the root is welded without - and otherwise with - suitable bath protection. Root welds can be made with full grinding of the deposit sites or via a suitable current program.

Root protection can be achieved by sealing off the housing of the mechanical accessory and admitting a protective gas (argon). In doing this, the position of the burner must be maintained "sharply."

The welding process in accordance with the invention can also be carried out with an electrode that does not melt away. In this case, the feature is provided in accordance with the invention that a steel wire is fed in in the cold or warm state as the additional working material, and the welds are made using the plasma process, whereby the root is welded without the addition of an additional working material using the plug welding technique with bath protection. Here, the welding current intensities amount to 80-250 A, and the quantity of protective gas amounts to 15-25 L argon/min. Argon with an addition of 5.4% hydrogen can be used as the plasma gas.

In accordance with the invention, root welding can be carried out using the tungsten/inert gas process or the plasma welding process, whereas the filling sites are deposited using the metal/active gas welding process and use is made of steel wire in both processes. These processes are provided when the housings of mechanical accessories are used in industrial plants in which metal/active gas welded root sites are not permitted, for example, in nuclear power stations.